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CAPE COD COMMISSION

February 28, 2017

Gerard Martin
Site Remediation Section
Southeast Regional Office
Department of Environmental Protection
20 Riverside Drive
Lakeville, MA 02347

Re: WSA-4-26179
Immediate Response Action
PFOS/PFOA in Groundwater

Dear Mr. Martin:

This is the third IRA monthly status report for the IRA approved by the Department in a letter dated November 10, 2016. The County has implemented the soil removal project and improved the capture of the pump and treat system from a flow rate of 21 to 70 gpm. The following report discusses both of these projects. We anticipate filing an IRA completion when we receive the full laboratory reports for the implementation.

RemBind Plus Amendment and Pre-Removal Testing

The County implemented the soil removal and RemBind Plus amendment according to the project description in the IRA Plan (Sept 27, 2016), the DEP approval letter (Nov 10, 2016) and the Request for Determination of Applicability (RDA) submittal (August 2016) and the Barnstable Conservation Commission negative determination. All these documents were included in the IRA Plan.

The DEP approval conditions required the County to provide both pre and post amendment monitoring for the 14 MCP metals. Upon request the Tersus Environmental LLC and Ziltec companies provided the County with a metals analysis of the RemBind Plus product. The TCLP analysis for leachable metals, was conducted by Environmental Division Melbourne, Springvale, Australia, by Leachable Metals by Inductively coupled plasma mass spectrometry **(**ICPMS). The results of the TCLP for the Metals indicated that all were less than the detection limit except for Barium, Copper and Nickel (Table 1). The Barium, Copper and Nickel detections were below the RCGW-1. Based upon the review of the results, the County purchased the RemBind Plus product on December 12, 2016. Three 700 kg bags of RemBind Plus were delivered on January 4, 2017 and stored in the Fire Academy building until the time of use.

Table 1 Metals in RemBind Plus Product

Metals		**mg/l**	**mg/l**
		RCGW-1	**Ziltek #2**
antimony		0.006	<0.01
arsenic		0.01	<.0005
barium		2	**0.4**
beryllium		0.004	<.001
cadmium		0.004	<.001
Chromium		0.1	<0.01
copper		10	**0.2**
lead		0.01	<0.01
nickel		0.1	**0.02**
selenium		0.05	<0.01
silver		0.007	<0.01
thallium		0.002	<0.01
zinc		0.9	<0.1
vanadium		0.03	<0.01
mercury		0.002	<0.001

The County conducted pre-removal sampling on December 8, 2016 of upgradient (HS-1) and downgradient (PRW-2) monitoring wells and Flintrock pond as specified in the IRA Plan DEP approval. Physical parameters of Dissolved Oxygen, pH, Specific Conductance were taken in the field. Spilt samples were delivered to the BCDHE laboratory for metal analysis and sent overnight to the Maxxam lab for Poly Fluorinated Alkyl Substances. The results are shown below (Table 2) and attached.

Table 2 Metals and PFAS in Pre-Soil Removal Groundwater

			8-Dec-16		
Metals		**mg/l**	**mg/l**	**mg/l**	**mg/l**
		RCGW-1	**PFW-2**	**HS-1**	**Flintrock**
antimony		0.006	ND	ND	ND
arsenic		0.01	0.0026	0.0016	0.001
barium		2	0.0065	0.014	0.0057
beryllium		0.004	ND	ND	ND
cadmium		0.004	ND	ND	ND
Chromium		0.1	0.0024	ND	ND
copper		10	0.0059	ND	0.0012
lead		0.01	0.0036	0.0017	0.0026
nickel		0.1	0.0084	0.0049	ND
selenium		0.05	ND	ND	ND
silver		0.007	ND	ND	ND
thallium		0.002	ND	ND	ND
zinc		0.9	0.01	0.0097	0.017
vanadium		0.03	0.0042	0.0037	0.0013
Aluminum		1	2.3	0.66	0.014
mercury		0.002	ND	ND	ND
DO	mg/l		0.6	1.42	11.1
pH	pH		5.66	5.79	6.3
Spec Cond	umho/cm		115	130	85
Temp	C		14.4	12.5	6.3
		HA			
PFOS	ng/l	70	13000	36000	1300
PFOA	ng/l	70	660	1800	130

Metals in groundwater and Flintrock Pond were either non-detect or at trace levels. Only Aluminum in groundwater from PFW-2 was elevated above the Reportable Concentration for a Groundwater-1 area. This well will be resampled during the post monitoring to evaluate the detection. Aluminum is an extremely abundant element in the earth's surface owing to its occurrence in typical minerals like feldspar and micas. The Dissolved oxygen was normal in Flintrock Pond but depressed in groundwater samples. The temperatures were cold in Flintrock Pond, as would be expected for December, and slightly above normal temperatures in groundwater at 10 C. Specific conductance was low for all samples. The PFOS and PFOA concentrations were highest in HS-1 which is in the sump area of the hot spot. The concentrations downgradient were lower than HS-1 by a third, but still 3 orders of magnitude greater than the Health Advisory of 70 ng/l. The pond, at 1,300 ng/l continues to have a high concentration of PFOS.

The County will be installing a monitoring well to replace HS-1 and then completing a round of post-removal sampling in the next month. Based upon the results of the RemBind test the County proposes to analyze the groundwater post-removal samples for the metals: Barium, Nickel Copper and Aluminum; field measurements and PFAS.

Soil Removal

The County prepared a Request for Quotes that was due on November 29, 2016. The Project was awarded to Earthworks of Plainville, Ma. The work began on Wednesday January 25 and was completed on January 27. An initial Bill of Lading was submitted to eDEP on January 3, 2017.

The contractor arrived on January 25th and set up the work and stockpile areas according to the Conservation Commission RDA. Excavated soil was placed on the stock pile area. On Tuesday stockpiled soil began to be removed and the bottom of the hole was amended with the RemBind Plus product. The RemBind Plus bag is hoisted by the excavator. The RemBind product is a very fine carbon mixture that is "poured" through an application port at the bottom of the bag. The RemBind Plus was worked into the bottom foot of the excavation and then top dressed with a fine layer. Clean sand from PA Landers was used to backfill the hole. The hole was backfilled to 1 foot

below ground surface and sloped away from the pond. A geotextile was placed on the sloped surface and loamy soil was used to bring the hole to ground surface. The project was completed on January 27, 2017.

The excavated soil was removed to the Waste Management Inc. facility located in Taunton, MA as specified in the Bill of Lading. The facility received 8 truckloads of soil that totaled 297.66 tons. The completed Bill of Lading was submitted on February 27, 2017.

Soil Sampling

Seven soil samples were taken over the two days of active excavation. The sample locations are shown in the figure and table below. The samples were taken from side wall areas and bottom of hole as described. Five of the 7 samples were mixed with the RemBind Plus Product to evaluate ex-situ treatment for a total of 12 samples. All samples were kept cool and shipped overnight to the Maxxam lab.

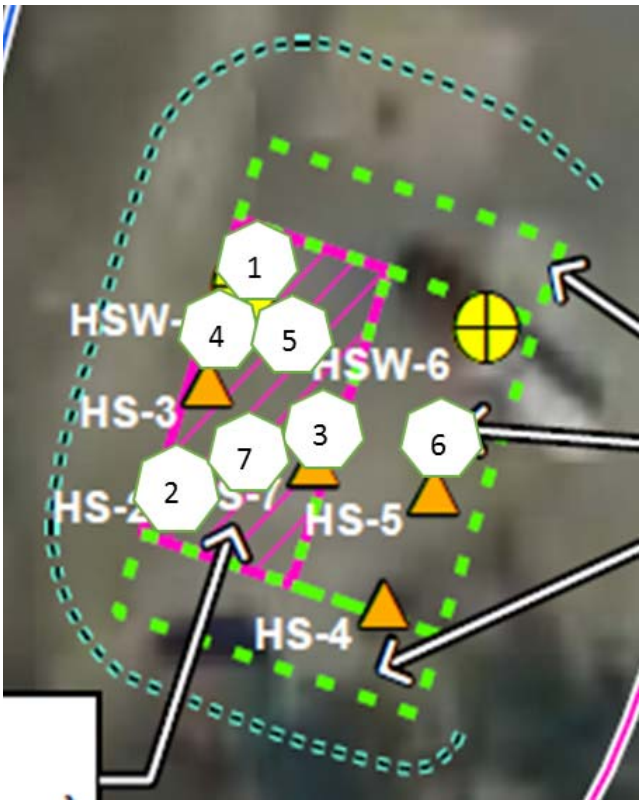

Figure 1 Hot Spot Soil Removal Sample Locations

Table 3 PFOS/PFOA in Soil (ug/l)

				ug/l	
ID #	Date	Time	Description	PFOS	PFOA
1	25-Jan	10:00 AM	B3 Side Wall West	460	<1.2
	26-Jan	2:30 PM	B3 Side Wall West Treated	300	<1.2
2	25-Jan	11:00 AM	Soil Horizon Deep West	280	1.8
	26-Jan	2:30 PM	Soil Horizon Deep West Treated	150	<1.2
3	25-Jan	1:00 PM	H7 Side Wall	180	0.22
4	25-Jan	2:30 PM	NW Lift Bot (B3sidewall)	970	4.2
5	25-Jan	2:00 PM	Bot Hole 1	110	0.68
	26-Jan	2:00 PM	Bot Hole 1 Treated	56	<1.2
6	25-Jan	2:45 PM	Bot of 5 ft Lift	270	<1.2
	26-Jan	2:00 PM	Bot of 5 Lift Treated	45	<1.2
7	26-Jan	8:00 AM	Bot Hole 2	180	2.2
	26-Jan	8:00 AM	Bot Hole 2 Treated	32	<1.2

Results

The highest PFOS concentrations in soil of 460 and 970 ug/l were found in samples #1 and #4 respectively, located in the original hotspot sump area that had the highest recorded PFOS soil concentration of 4,200 ug/l. The samples #5 and #7 located at the bottom of the excavation the hotspot area had the lowest PFOS concentrations at 110 and 180 ug/l. Sample #3 was taken from the pavement area had a concentration of 180 ug/l as compared to 2000 ug/l in the location of Boring 7 in the previous soil sampling and sample #6 was taken at the 5-foot excavation depth.

Several samples were mixed with the RemBind Plus product and also sent for analysis. There were measured decreases of the PFOS/PFOA concentrations in the treated soil. The decreases ranged from 84 to 35 percent. The higher decreases were measured in the bottom of hole samples while the smaller decreases were associated with the higher PFOS concentration soil that was removed from the hotspot. Portions of the removed soil contained organic material as fill, so it is likely the reworked organic (carbon) material had strongly bonded to the PFAS. Ziltec, the manufacturers of RemBind Plus,

indicate that a >95% decrease is typically expected when soil is mixed with 5% product at a moisture content of 40%. However, the in place treatment conducted here is an atypical application and the treatment samples were not brought up to 40% moisture content. It is likely that the reductions in-situ maybe higher after a period of time due to restoration of the capillary fringe in the disturbed soil and infiltration. Post removal monitoring of groundwater beneath the treated area will provide further information to compare post to pre-soil removal concentrations.

The hotspot removal area will be instrumented with a monitoring well for an “upgradient” location as part of the DEP approval conditions to monitor the Pond and upgradient and down gradient groundwater for PFOS and metals.

Groundwater Pump and Treat

The Groundwater pump and treat system suffered an inadvertent shut down at the end of the year due to a local power outage that resulted in a blown electrical contactor at the well site. A system sample set was collected on January 4th. The influent for PFOS and PFOA concentrations were 4900 ng/l and 380 ng/l respectively, and the effluent was non-detect for both. The system was deliberately shut down on January 18th for improvements to increase the pumping rate as indicated in the IRA. The last system flow measurement was approximately 20 gpm.

Work to improve the flow rate consisted of several days of diagnostic cleaning the lines of iron fouling with acid and purging the lines with fire hydrant flow. There are two 2-inch force mains that run 1,000 ft from the PRW-4 recovery well to the treatment building. A mini -excavator was used to access the force lines so they could be coupled and decoupled. The treatment lines were coupled at the PRW-4 site. A 300 -gallon bulk tank was set-up in the treatment building with a pump attached to one of the lines going to the well site with a return loop back to the bulk tank in the other line. The initial flow rate through the 2000 ft loop of coupled lines was 12 gpm. The bulk tank was acidified with descaler (hydrochloric acid) to a pH of 1. The bulk tank pump was run to recirculate the descaler through the lines. The pH was monitored and increased overnight to a pH of 3.5. The water was re-acidified and recirculated through the lines for several days. A midway station was dug at a point between the on-site lines which

were installed in 1994 for the petroleum cleanup and the off-site lines were installed in 2007 for the perchlorate cleanup. The lines were coupled to a fire hydrant source so that water could be forced up to the well and back to the treatment building to diagnose the lines. The bulk tank was sufficiently diluted prior to draining to the ground. The use of the descaler and hydrant significantly improved the flow of the 2-inch lines to 90 gpm each when the hydrant was used as a source. The 4-inch recovery well was also treated with descaler and purged prior to putting the 55 gpm pump back into the well. The pump and treat system was resumed on January 30 at a flow rate of 46 gpm, as measured at the treatment building. It ran for two days until an electrical coil was blown at the well. During the week of February 6th a new pump (GS85HP3) with greater horsepower requiring an electrical upgrade was installed. Due to the Winter storms the start-up was delayed until Feb 14, 2017. The pump rate measured at the treatment building is 70 gpm. The influent and system samples were collected at the end of the week. There is only one system sample from early January to report on for this February period.

The County plans to install the monitoring well in the soil removal area for post -removal monitoring and several monitoring wells to better define the southern and northern influence of Flintrock pond and downgradient groundwater as indicated in the IRA Plan.

The County anticipates filing an IRA Completion Statement in the next month and would like to discuss how to continue our remedial actions under the primary RTN 4-190.

Please contact me if you have any questions on this submittal.

Sincerely,

Tom Cambareri
Technical Services Director for Water Resources
LSP #3788

Cc: Jack Yunits, County Administrator